

# HIRLAM surface analysis for climate purposes

*C. Peral*  
*B. Navascués*  
*P. Ramos*  
*E. Rodríguez*

# HIRLAM surface analysis for climate purposes

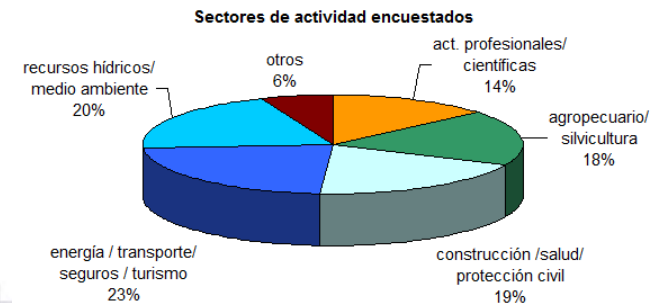
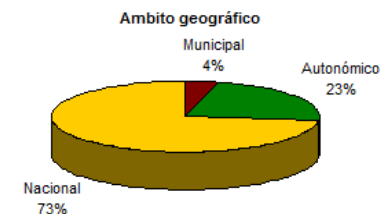
*why?*

# Implementation of GFCS in Spain



## User perception

*(2013 survey to users of climate services in Spain)*



- Users requirement: high resolution for climate data and operational climatological products*

- Historically, two separate worlds:
  - World of climate → station data → grids
  - World of prediction/models → data assimilation → grids

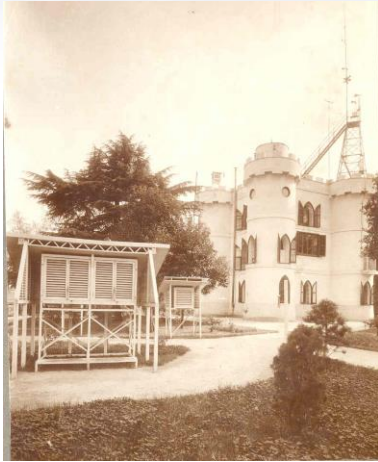


# Goals

- 1. To develop a tool for the automatic production of high-res gridded climate data at daily scale*
- 2. Generate a time series of gridded precipitation and temperature data since 1950 onwards*
- 3. Usage this dataset for the operational production of climate services in AEMET*

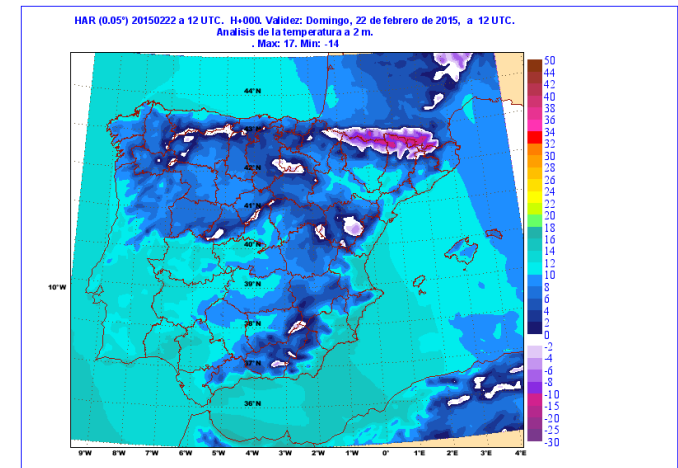


# Components



## Time series of quality controlled climate data

## Analysis



GOBIERNO DE ESPAÑA  
MINISTERIO DE AGRICULTURA, ALIMENTACIÓN Y MEDIO AMBIENTE  
Aemet  
Agencia Estatal de Meteorología

Bienvenido Benvinguts Benvidos Benvinguts Ongietorri Willkommen Bienvenue


Web móvil Enlaces Noticias Mapa web Ayuda web Contactar

Buscar: Introduzca texto

Inicio > Servicios climáticos


### Servicios climáticos

A través de los Servicios Climáticos los datos e información climática básica se transforman en productos y aplicaciones climáticas específicas útiles para usuarios de los diversos sectores. En este apartado se incluye información climatológica general sobre valores medios y extremos de las series de datos climatológicos, productos de vigilancia del clima, predicciones de rango estacional, y proyecciones de cambio climático para el siglo XXI para España bajo diferentes escenarios de emisión.




### Datos climatológicos

Información climatológica básica.




### Vigilancia del clima

Información sobre la evolución reciente del clima.




### Predicción estacional

Predicciones de alcance estacional.



### Cambio climático

Proyecciones regionalizadas de cambio climático para el siglo XXI.



Sede electrónica

El tiempo

El tiempo en su Web

Municipios españoles

Buscar municipio...

Plavas

## Production and delivery

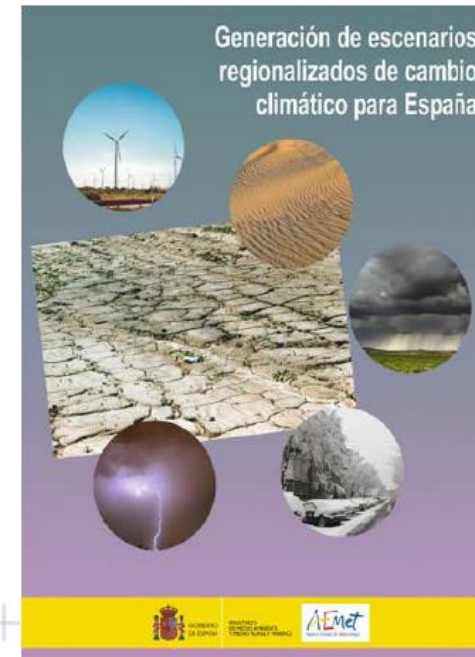
# Components

## Time series of quality controlled climate data



- Data archived at the Banco Nacional de Datos Climatológicos

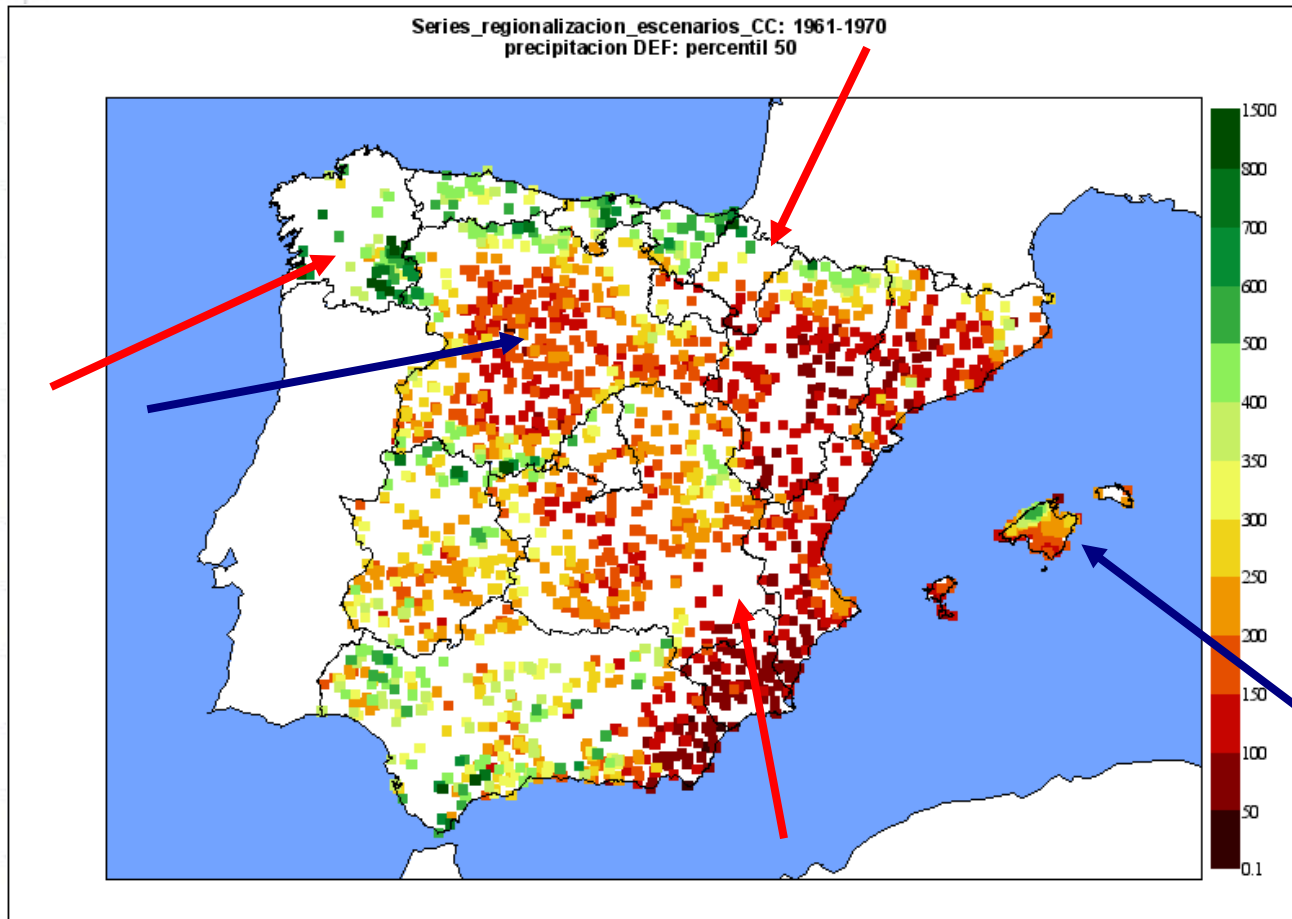
- Selection of observations: same QC criteria already used at AEMET for statistical downscaling of CC global projections (completeness and homogeneity of time series)



# Components

Time series of quality controlled climate data

Inhomogenous horizontal resolution of final observation dataset



e.g.  
precipitation

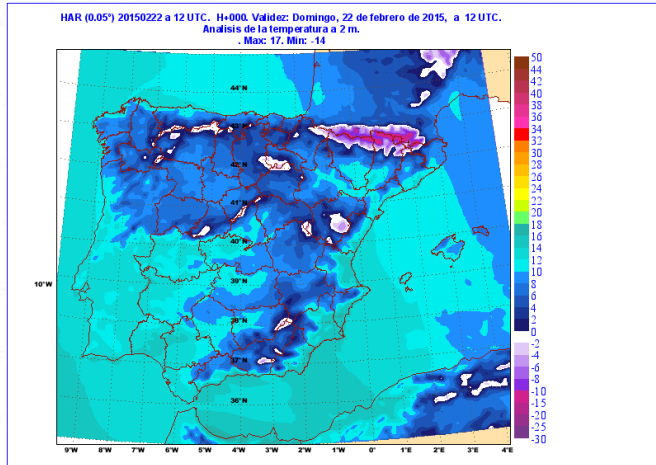


# Components

## Analysis

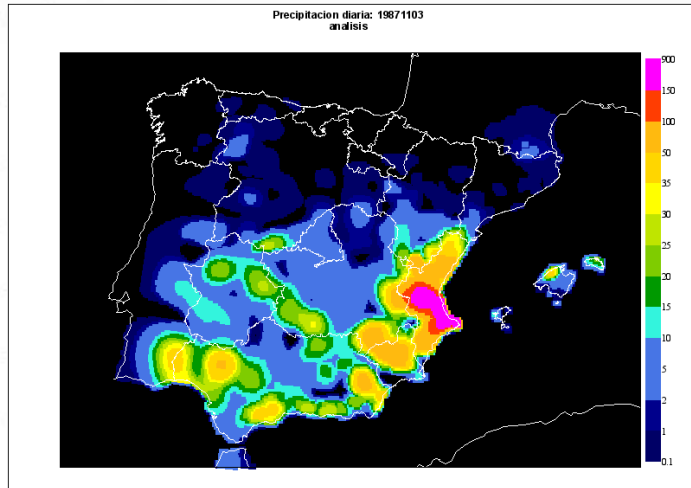
Starting point:

- HIRLAM surface analysis package used operationally by HIRLAM NMHs
- Optimal interpolation method (BLUE)
- First-guess: HIRLAM short range forecasts
- Observations: SYNOP reports and automatic stations data from AEMET and CH's
- Operational analysis of surface temperature, rh, snow depth, wind components (bivariate), pmsl & precipitation



## Documentation:

- Navascués, B., 1997: Analysis of 2m temperature and relative humidity. *HIRLAM Technical Report 28*.
- Navascués, B., E. Rodríguez, J.J. Ayuso and S. Järvenoja, 2003: Analysis of surface variables and parameterization of surface processes in HIRLAM. Part II: Seasonal assimilation experiment. *HIRLAM Technical Report 59*.
- Rodríguez, E., B. Navascués, J.J. Ayuso and S. Järvenoja, 2003: Analysis of surface variables and parameterization of surface processes in HIRLAM. Part I: Approach and verification by parallel runs. *HIRLAM Technical Report 58*.
- Cansado, A., Martín, C., Navascués, 2004: Optimum Interpolation new snow depth analysis in HIRLAM, *HIRLAM Newsletter 45*, 248-252
- Martín, C., and B. Navascués, 2004: Estimation of structure functions for the analysis of two-meter temperature and relative humidity. *Proceedings of SRNWP/HIRLAM Workshop on Surface Processes, turbulence and mountain effects*. Norrköping, Sweden, 15-17 September 2004
- Cansado A., 2002: "Ampliando el análisis de superficie en HIRLAM. Análisis de la presión a nivel del mar", Nota Técnica N°62, Servicio de Modelización Numérica del tiempo, INM.
- Cansado A., 2002: "Análisis bivalente del viento a 10m por interpolación óptima", Nota Técnica N°64, Servicio de Modelización Numérica del tiempo, INM ...



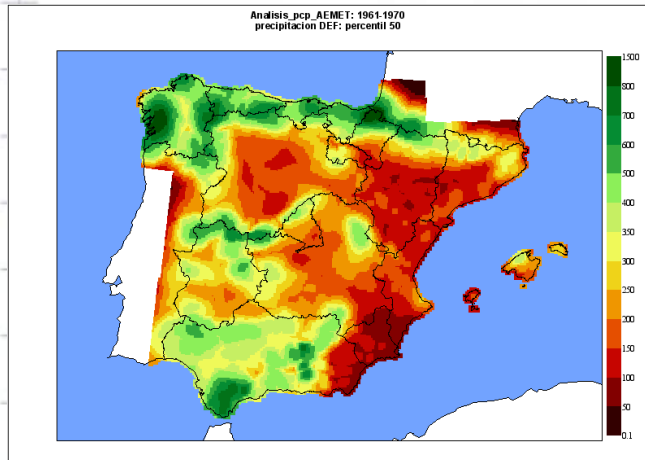
HIRLAM surface analysis package adapted for climate purposes:

- First-guess (depends on the variable)
- Observations: QC'd rain gauge (2200 aprox) and temperatures (365 aprox) from BNDC
- Tuning of background and observation error statistics (Hollingswoth & Lonnberg method)
- Check if random bias estimation is needed (Dee & Da Silva)

Some background error statistics features:

- Preliminary length scale for precipitation follows Mahfouf et al. (2006)
- Anisotropic structure functions (due to orography, Navascués 1999)
- Seasonal and time of the day dependences (Martin and Navascués )

# Components Production and delivery

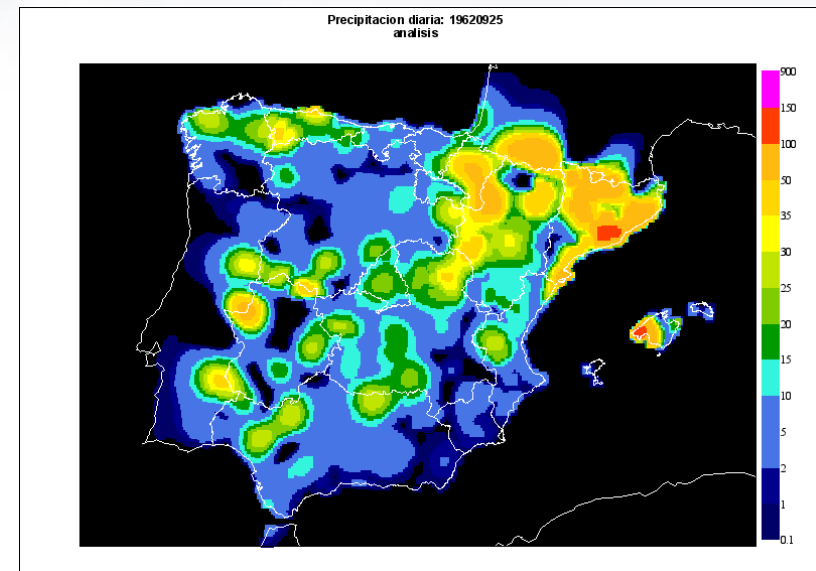
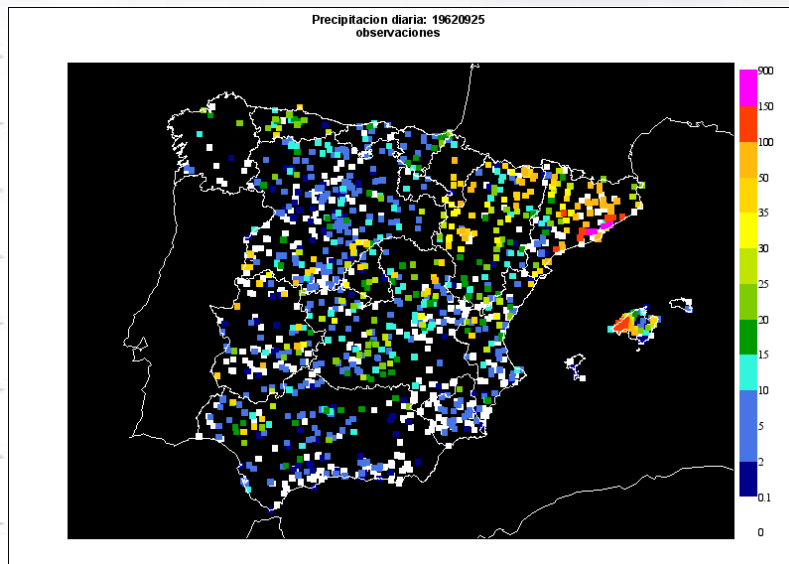


- 5km grid spacing (not analysis horizontal resolution)
- analysis resolution: produced by observations spatial distribution and tuned background error statistics
- precipitation first, temperatures afterwards
- output: daily files in ascii, grib, netcdf...
- mask of the Spanish territory and each of the CCAA, provinces, river basins...

## Product assessment:

- Analysis diagnostics: innovations & residuals distribution...
- Comparison against independent observations and other reference datasets
- Climatologies (from analysis and observations)
- Homogeneity tests on single grid points...

# Components Production and delivery

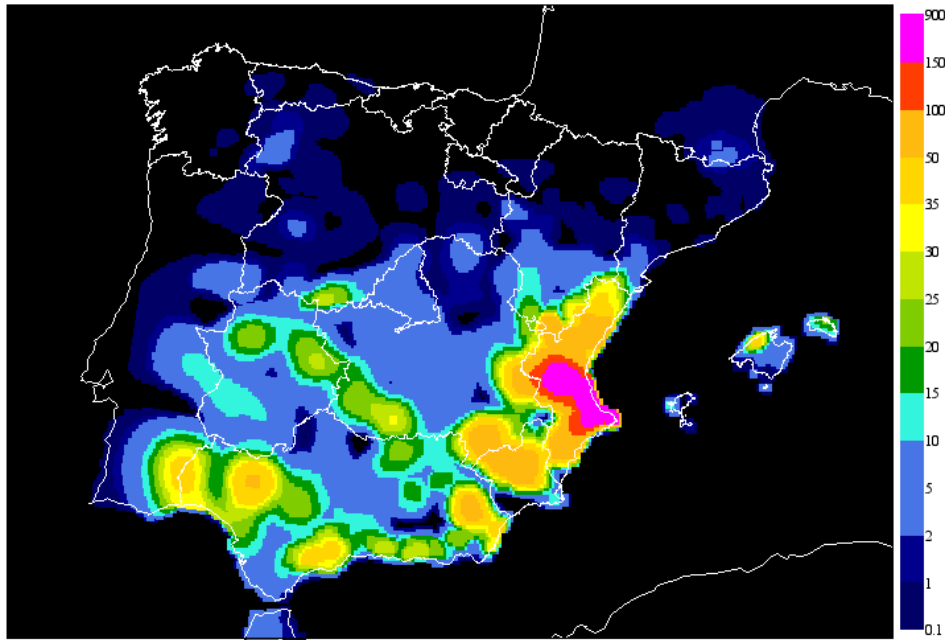


## Future operational product:

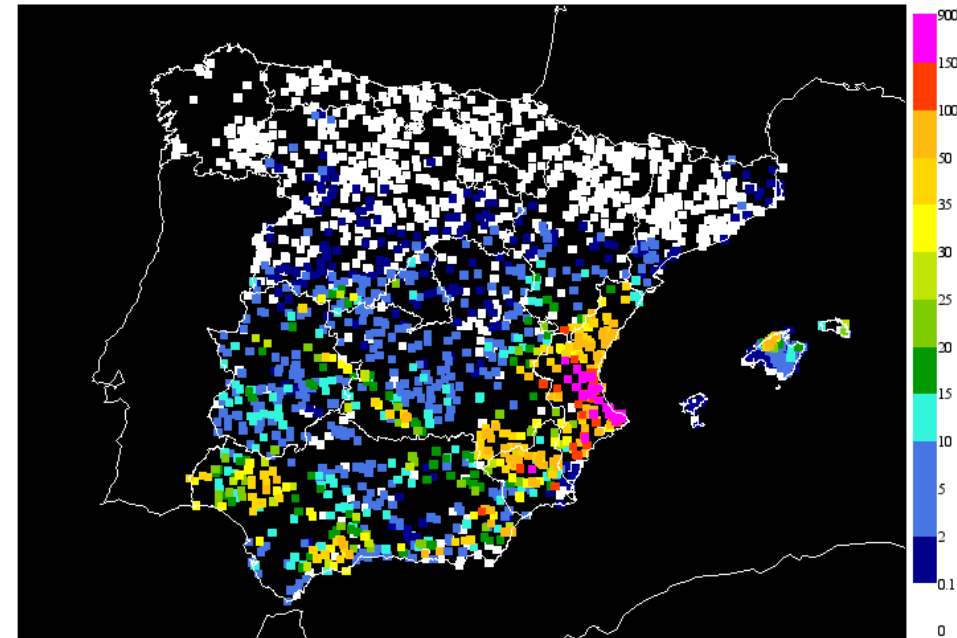
- nrt update and consolidated versions planned
- basis for other climate services delivered by AEMET
- potential collaboration with IM Portugal to spatially extend the analysis and to include Portuguese climate data

# Some preliminary trials

Precipitación diaria: 19871103  
análisis



Precipitación diaria: 19871103  
observaciones



**Gandía flood**  
**analysis 19871103**



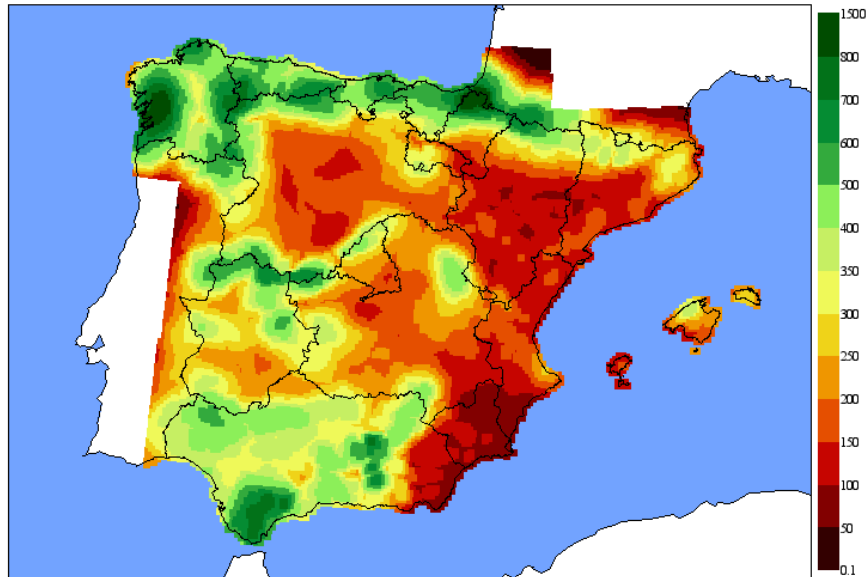


GOBIERNO  
DE ESPAÑA

MINISTERIO  
DE MEDIO AMBIENTE  
Y MEDIO RURAL Y MARINO

Aemet  
Agencia Estatal de Meteorología

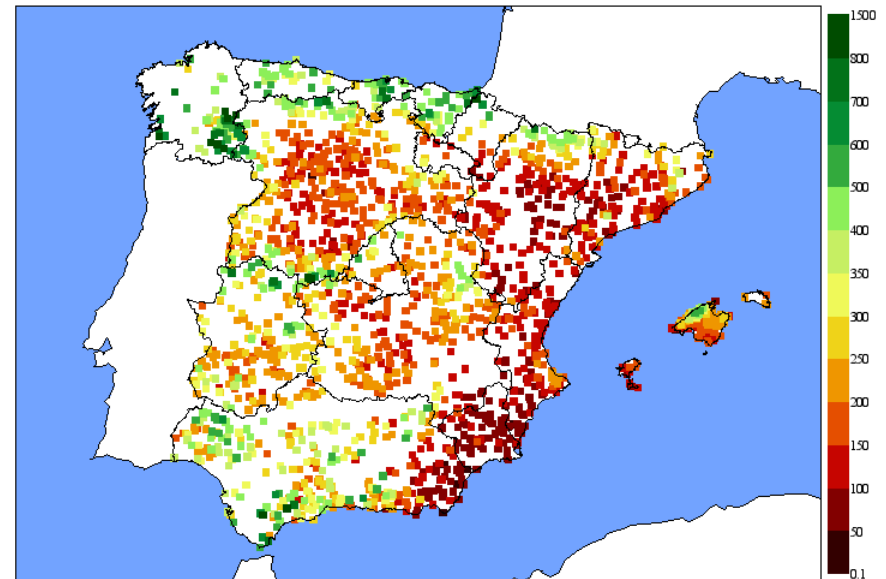
Analisis\_pcp\_AEMET: 1961-1970  
precipitacion DEF: percentil 50



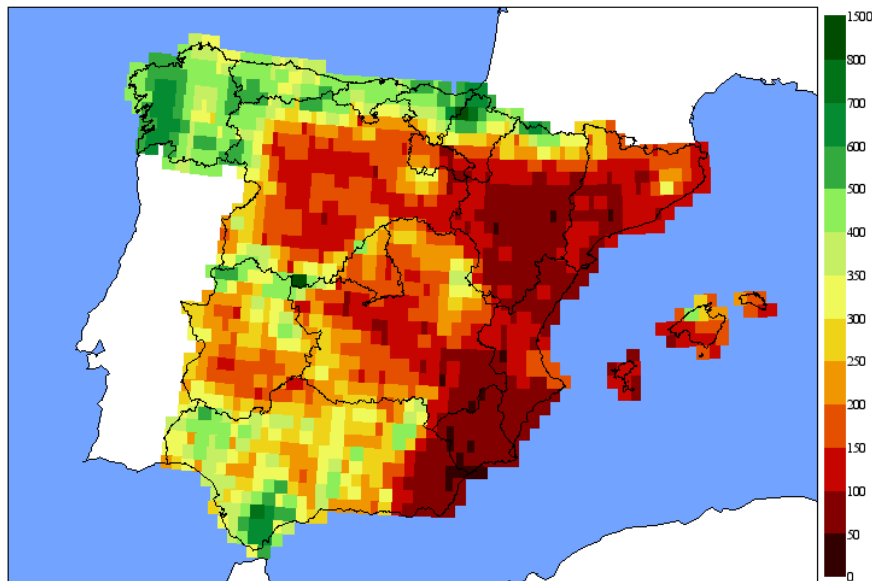
# Preliminary trial:

## P50 DEF 1961-1970

Series\_regionalizacion\_escenarios\_CC: 1961-1970  
precipitacion DEF: percentil 50



Rejilla\_pcp\_Spain0.2v2: 1961-1970  
precipitacion DEF: percentil 50





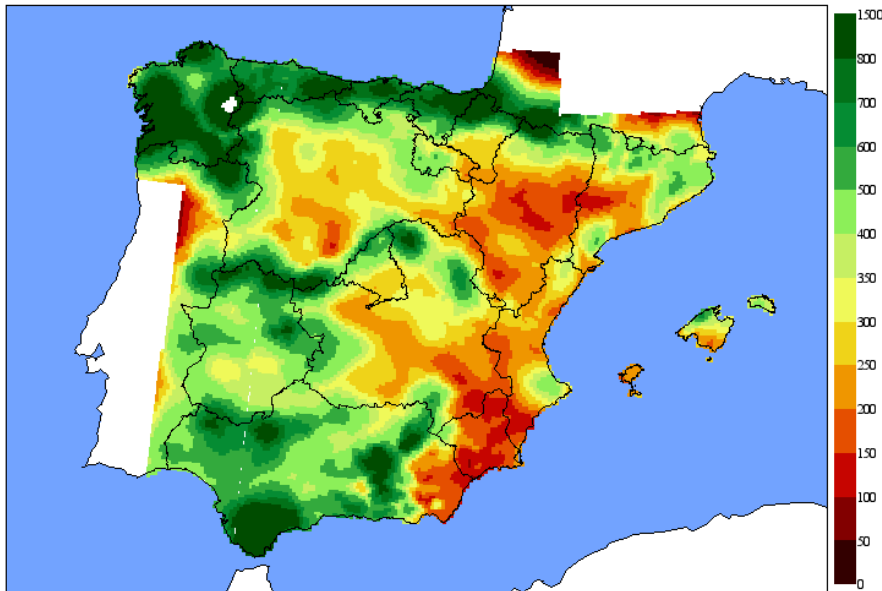
GOBIERNO  
DE ESPAÑA

MINISTERIO  
DE MEDIO AMBIENTE  
Y MEDIO RURAL Y MARINO

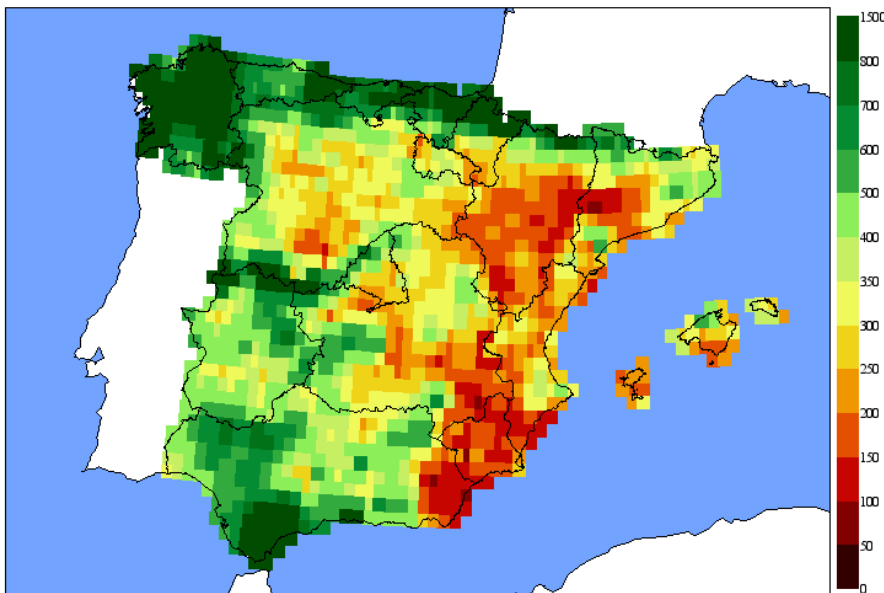
AEMet  
Agencia Estatal de Meteorología

# Preliminary trial: P95 DEF 1961-1970

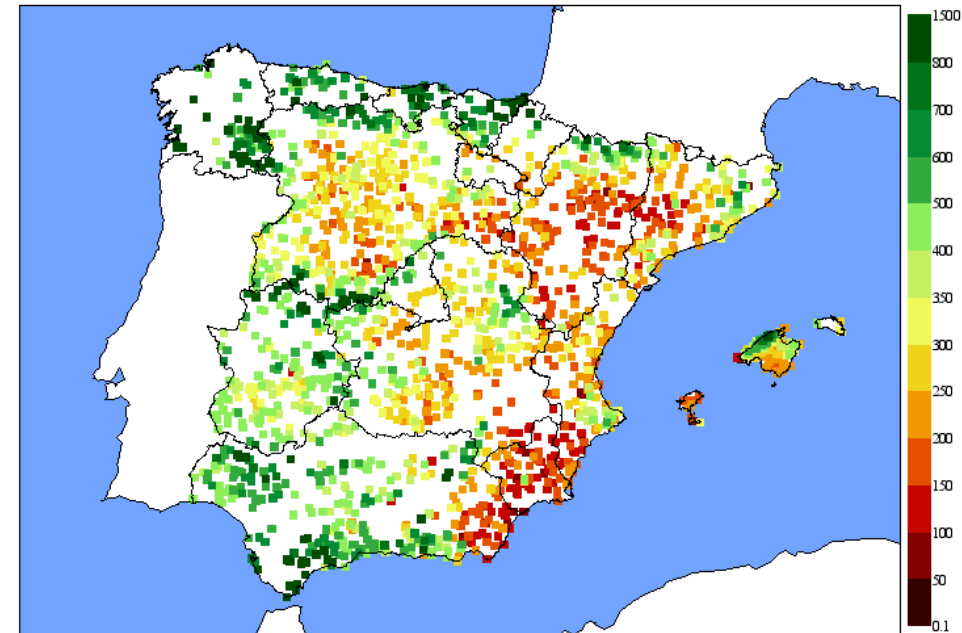
Analisis\_pcp\_AEMET: 1961-1970  
precipitacion DEF: percentil 95



Rejilla\_pcp\_Spain0.2v3: 1961-1970  
precipitacion DEF: percentil 95



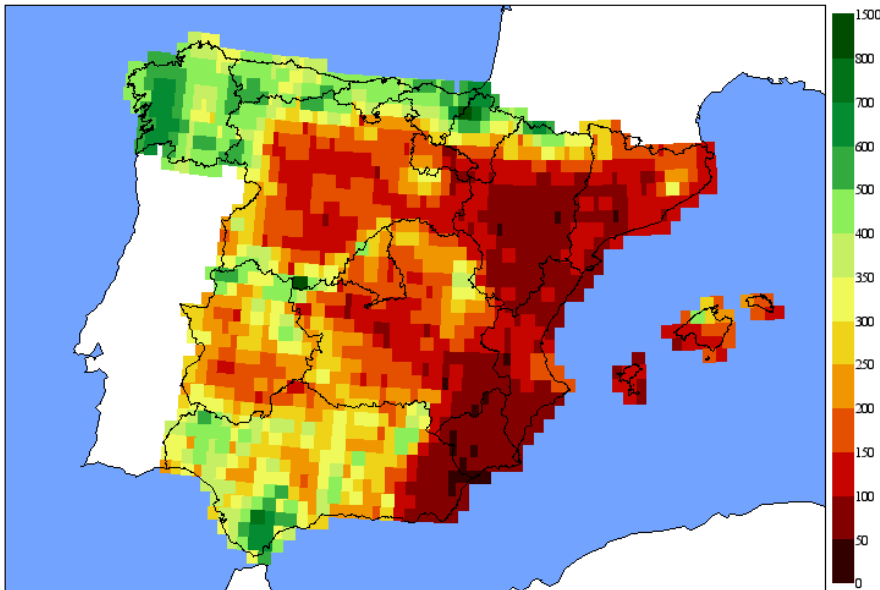
Series\_regionalizacion\_escenarios\_CC: 1961-1970  
precipitacion DEF: percentil 95



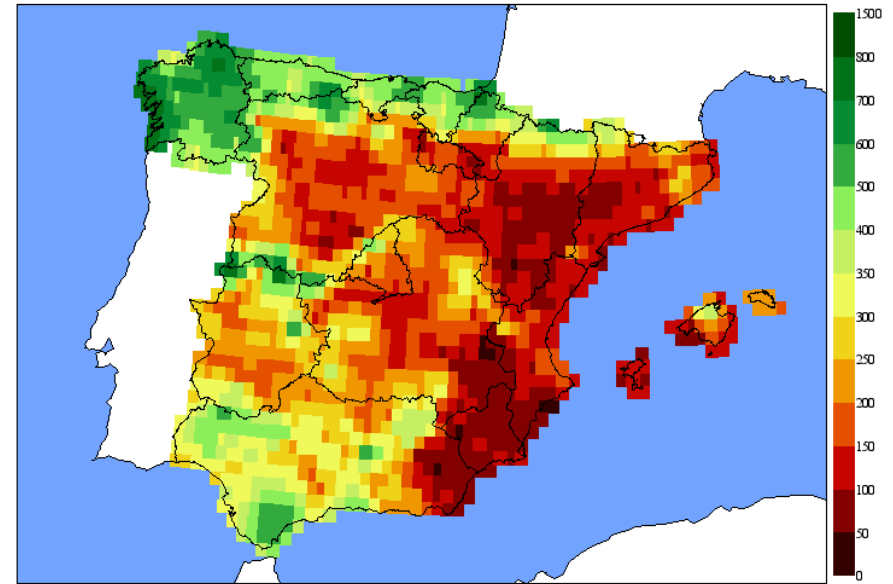
# Spain02v2 vs Spain02v3:

P50 DEF 1961-1970

Rejilla\_pcp\_Spain0.2v2: 1961-1970  
precipitación DEF: percentil 50



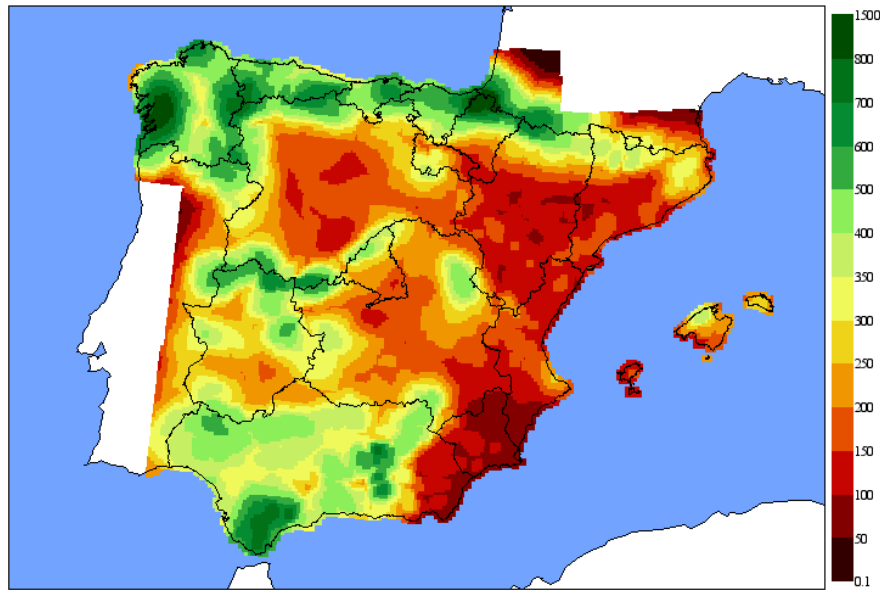
Rejilla\_pcp\_Spain0.2v3: 1961-1970  
precipitación DEF: percentil 50



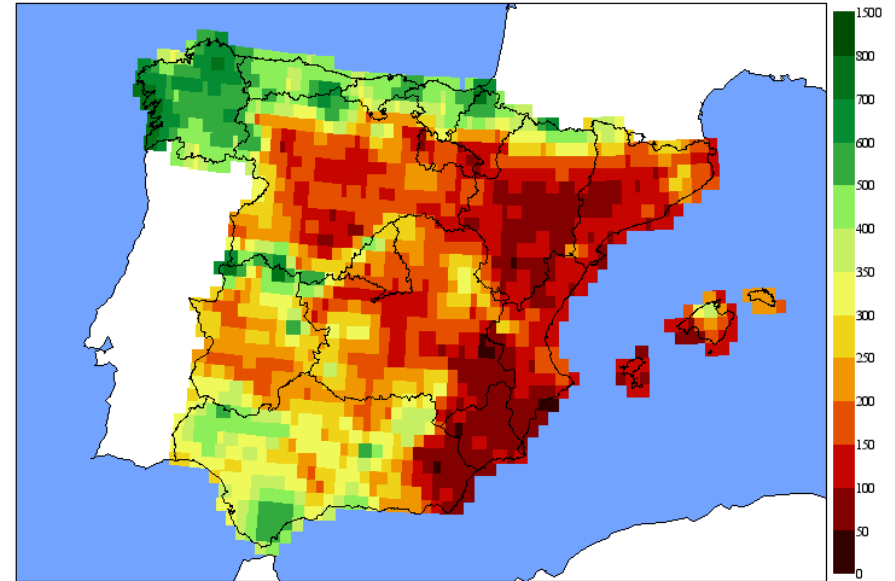
# Span (preliminary) vs Spain02v3:

## P50 DEF 1961-1970

Analysis\_pcp\_AEMET: 1961-1970  
precipitación DEF: percentil 50



Rejilla\_pcp\_Spain0.2v3: 1961-1970  
precipitación DEF: percentil 50



# CONCLUSIONS

- New gridded precipitation and temperature data since 1950 (work in progress) based on HIRLAM surface analysis developed at AEMET and used operationally by HIRLAM NMHs
- Based on time series of QC climate data
- Automatic nrt production at high-res (5 km) and daily scale
- Core dataset for the operational production of climate services from AEMET